

Review of San Joaquin Renewables (SJRenew) Responses to EPA’s Questions about the Financial Responsibility Demonstration

In April 2022, EPA provided questions presented in **blue text** to San Joaquin Renewables (SJRenew) about their financial responsibility demonstration (dated November 3, 2021) for their planned GS project. SJRenew provided updated cost estimates (SJR_FR_cost-estimates_062122.xls) and a document summarizing their responses (Response_062122) to EPA on June 21, 2022. EPA’s evaluation of how the revised financial responsibility cost estimates address its questions and requests for revisions and additional information are presented in **red text**.

PART 1: Cost Estimate Evaluation

The SJRenew project consists of one injection well, which is projected to inject a total of 6,570,000 tons of CO₂ into the Vedder Formation over a period of 15 years. According to the permit application, the AoR for the project is 73 square miles and there is an underground source of drinking water (USDW) within the AoR of the project.

To evaluate SJRenew’s financial responsibility demonstration, EPA compared the cost estimates provided by the applicant in their Class VI permit application to those generated by EPA’s Cost Estimation Tool for Class VI Financial Responsibility Demonstrations (the Cost Tool). EPA developed the Cost Tool to provide an “acceptable range of costs” (including a high-end, middle range, and low-end cost estimate) for Class VI financial responsibility activities based on information submitted with a permit application.

For this evaluation, EPA determined the Cost Tool inputs based on information in SJRenew’s permit application. These inputs include the size of the AoR, the presence/absence of USDWs in the AoR, the amount of CO₂ to be injected, the duration of the PISC period, the depths and diameters of the injection and monitoring wells in the AoR, and the characteristics of any deficient wells in the AoR requiring corrective action. Exhibit 1 presents the Cost Tool inputs EPA used.

Exhibit 1. Cost Tool Inputs.

Project Information	
Variable Name	Value
Project Name (Corporate entity)	San Joaquin Renewables
Project Address/Location	McFarland, CA

Project Data		
Variable Name	Value	Units (Click in Cell for Dropdown List)
Size of Area of Review (AoR)	73	Square Miles
Are There Underground Sources of Drinking Water (USDWs) in the AoR?	Yes	
Mass of CO ₂ to be Injected	6,570,000	Tons
Duration of Post-Injection Site Care	15	Years
Depth of Injection Well	8,700	Feet
Diameter of Injection Well	7.00	Inches

Information on Monitoring Wells Note: Cost to clean out monitoring wells is based on a regression equation that is only valid for well depths greater than 2,000 ft. Model is run for all monitoring wells (where the shallow wells are conservatively assumed to be 2,001 ft deep).

13 -- Number of Monitoring Wells

Enter the names, depths (feet), and diameters (inches) of monitoring wells in the table below.

Well Name	Delano # 14	Delano # 23	Delano # 30	McFarland Tayl	SSJMUD # 8	SSJMUD # 14	SSJMUD # 23	SSJMUD # 42	SSJMUD # 53	SSJMUD # 59	SSJMUD # 62	ACZ well	Vedder well
Well Depth (feet)	2,001	2,001	2,001	2,001	2,001	2,001	2,001	2,001	2,001	2,001	2,001	7,095	6,672
Well Diameter (inches)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	7.00	7.00

Information on Deficient Wells in the AoR Requiring Corrective Action

6 -- Number of Deficient Wells in the AoR that will be Remediated

Enter in the names, depths (feet), and diameters (inches) of deficient wells in the aor requiring corrective action in the table below.

Well Name	API402930522	API402930605	API402930607	API402930608	API402970053	API402980729	[Well Name]	[Well Name]	[Well Name]	[Well Name]	[Well Name]
Well Depth (feet)	7,250	7,214	6,850	6,530	9,103	8,290					
Well Diameter (inches)	7.625	7.625	7.625	11.000	10.750	8.750					

As noted below, the specific activities that the Cost Tool assumes will be employed may differ from those in the approved project plans that describe specific activities that SJRenew will perform. However, because the goal of the financial responsibility requirements is to ensure that sufficient resources are available to cover the costs of EPA engaging a third party to complete the activities (i.e., if SJRenew were to become financially insolvent), the activities do not need to be identical. Where they differ, the ranges of estimates generated by the Cost Tool can be considered appropriate for evaluation purposes. The particular activities that SJRenew must perform are specified in the approved project plans that will be attached to the permit.

Comparison of Financial Responsibility Cost Estimates

Exhibit 2 compares the financial responsibility cost estimates provided by SJRenew (Column A) to the estimates EPA generated using the Cost Tool (Column B).

Exhibit 2. Comparison of Cost Estimates Provided by SJRenew and Generated by EPA

Financial Responsibility Categories	A. SJRenew Submission (2021\$)	B. EPA Cost Tool Estimate (2021\$)
Corrective Action	\$1,329,000	\$299,720 to \$1,286,200
Injection Well Plugging	\$234,600	\$129,800 to \$311,520
PISC and Site Closure	\$3,489,200	\$26,533,480 to \$51,206,100
E&RR	\$25,338,750	\$13,027,200 to \$89,996,240
Total Amount Needed to Show Financial Responsibility	\$30,391,550	\$39,989,020 to \$142,798,880

Notes:

- (1) Numbers may not appear to add due to rounding.
- (2) The PISC and Site Closure estimate shown combines separate cost estimates for post-injection site care and site closure, which are discussed below.
- (3) EPA assumes that SJRenew's cost estimates are in 2021\$.

The following subsections discuss the assumptions that may contribute to differences between these cost estimates.

Performing Corrective Action on Deficient Wells in AoR

SJRenew estimates the cost of corrective action on deficient wells in the AoR to be \$1,329,000; this is slightly above the high-end of the range of estimates generated by the Cost Tool (which are between \$299,720 and \$1,286,200, with a middle-range estimate of \$553,420).

EPA generated the cost estimates based on information about six wells in the AoR that SJRenew plans to re-abandon, including depths listed on Table 2-1 of the AoR CA and the diameter of all but one of the wells on well schematics in Appendix C to the AoR corrective action. The diameter at total depth of API 402970053 is unknown; so, EPA conservatively assumed the diameter of the intermediate casing (10.75 inches) for the Cost Tool input. SJRenew plans to implement corrective action on a phased basis, by plugging one well prior to injection and plugging the remaining five wells within three years of commencing injection activities.

SJRenew sources the corrective action cost estimate from Driltek, which appears to be a drilling/service company. The cost estimate appears to be acceptable. However, if, based on the AoR modeling review a larger AoR is determined to be needed and there are any additional deficient wells in the AoR, the cost estimate would need to account for corrective action on these wells.

Plugging the Injection Well

SJRenew estimates the cost of plugging their Class VI injection well to be \$234,600; this is slightly above the middle-range estimate of \$193,520 generated by EPA's Cost Tool (which generated costs ranging from \$129,800 to \$311,520). EPA generated the cost estimates based on the depth and diameter of the injection well as described in the permit application narrative. SJRenew's cost estimate is sourced from a drilling/service company.

Post-Injection Site Care and Site Closure

EPA estimates the costs of all PISC and site closure activities to range from \$26,533,480 to \$51,206,100, with a middle-range estimate of \$38,950,620. This is higher than the sum of SJRenew's estimate for these activities (which is \$3,489,200). The Class VI Rule, at 40 CFR 146.85(a)(2)(iii), requires permit applicants to show adequate financial coverage for PISC and site closure activities combined; the assumptions underlying the PISC and site closure cost estimates are discussed separately below.

Post-Injection Site Care

SJRenew's cost estimate for post-injection site care activities is \$3,066,000. This is significantly lower than the estimate EPA generated using the Cost Tool, which ranges from \$25,505,700 to \$48,330,440, with a middle-range estimate of \$37,443,760.

The post-injection monitoring activities that SJRenew plans to perform are similar to those assumed by the Cost Tool estimates. In their PISC and Site Closure Plan, SJRenew plans to continue the injection-phase monitoring, which includes:

- Water quality monitoring in one above confining zone (ACZ) monitoring well in the Olcese Formation, which occurs from approximately 6,625 to 7,095 feet.
- Shallow water quality monitoring using existing public and privately-owned wells.
- Pressure front tracking in one monitoring well in the Vedder Formation, which is approximately 6,672 feet deep.

SJRenew also plans to perform two post-injection 3D seismic surveys, including one following cessation of injection and one at the end of the post-injection site care timeframe.

EPA's Cost Tool and SJRenew estimate the post-injection monitoring costs based on similar activities:

- SJRenew's cost estimate assumes geochemical monitoring in the USDW, ACZ, and injection zone monitoring wells; pressure monitoring in the ACZ and injection zone monitoring wells; O&M of the ACZ well; mechanical integrity testing of the injection zone monitoring well; 3D seismic surveys; and reporting and project management.
- EPA's Cost Tool estimates include the cost for fluid analysis and O&M in all monitoring wells, seismic surveys, and report preparation.

There are significant differences between the cost estimate provided by SJRenew and the estimate generated by the Cost Tool. These may be due to differences in the following assumptions:

- Seismic survey extent. SJRenew's cost estimate assumed that 3D seismic surveys will be performed over an area of 6 square miles (consistent with their PISC and Site Closure Plan). However, the Cost Tool estimate for this activity is based on the size of the AoR, which is significantly larger (73 square miles, according to the Permit application narrative, pg. 3). This difference accounts for approximately \$16.4 million to \$32.9 million of the cost tool estimate.
- Operating and maintenance (O&M) cost estimates. SJRenew only estimates this activity for the ACZ monitoring well; while the Cost Tool estimate is based on the number and depth of all monitoring wells associated with the project. Post-injection monitoring well O&M for the 11 USDW wells accounts for about \$4 million to \$5 million of the total Cost Tool-generated estimate. Since 11 of the 13 wells are not owned by SJRenew, the applicant would probably not be likely to incur these O&M costs.¹ However, SJRenew's cost estimate should account for O&M of the Vedder Formation monitoring well. Further, because there is currently no precise information about the depth of the ACZ or the Vedder formation wells, EPA assumed the depths of these wells to be the deepest reported depth of these formations; this may overestimate the actual depths of the monitoring wells, and therefore the O&M costs, although not significantly.
- Number of shallow fluid sampling events. SJRenew only assumes fluid sampling in one USDW well annually, for a total of 15 sampling events over the PISC timeframe; however, the PISC and

¹ While these O&M costs would need to be incurred if, e.g., the owners ceased to operate the wells, any change in the number of monitoring wells would necessitate a change to the PISC and Site Closure Plan and a revised financial responsibility cost estimate.

Site Closure Plan describes monitoring in 11 shallow wells. Thus, SJRenew appears to be undercounting the number of fluid samples. This difference in the number of fluid sampling events accounts for about \$10,000 to \$40,000 of the Cost Tool estimate.

Note that, due to the specific calculations performed by the Cost Tool, the differences described above are not necessarily additive. However, based on an assumed 6 square-mile AoR (the extent of the seismic surveys) and sampling in only 3 monitoring wells (consistent with SJRenew's cost estimate), the Cost Tool-generated estimate for PISC activities would range between \$5,373,720 and \$10,032,360, with a middle-range estimate of \$7,737,260, which is still higher than SJRenew's estimate. Also note that SJRenew's proposed 15-year alternative PISC timeframe is subject to EPA's approval.

Site Closure

SJRenew estimates the cost of site closure to be \$423,200; this is below the Cost Tool estimate of \$1,027,780 to \$2,875,660, with a middle-range estimate of \$1,506,860.

The difference in the estimates is primarily because SJRenew's cost estimate does not include the cost to plug any of the USDW monitoring wells (which are not owned by the applicant, and their closure would not be related to activities at the injection project). If the shallow wells are not included in the Cost Tool inputs, the Cost Tool-generated site closure cost estimate would range from \$295,000 to \$709,180, with a mid-range estimate of \$440,140, which is similar to SJRenew's estimate.

EPA also notes the following uncertainties in the Cost Tool inputs related to the ACZ and Vedder Formation monitoring wells. While these do not affect the evaluation, they will need to be ascertained to finalize the cost evaluation.

- Because there is currently no specific information about the depth of the ACZ or the Vedder Formation monitoring wells, EPA assumed the depths of these wells to be the deepest reported depth of these formations. This likely overestimates the actual depth of the monitoring wells, and therefore the plugging costs.
- No information was provided about the diameters of the monitoring wells. Therefore, EPA assumed that the diameter of each of these wells would be 7 inches, which is commensurate with deep monitoring wells in other Class VI projects and the depth of the injection well.

The depth and diameter of the wells will need to be ascertained to confirm the cost estimate. If their depths or diameters change based on additional project activities, the post-injection site care cost estimate may need to be revised accordingly.

Emergency and Remedial Response²

SJRenew's emergency and remedial response cost estimate is \$30,391,550, which is slightly above the middle-range estimate of \$27,462,140 (EPA's estimate ranges from \$13,027,200 to \$89,996,240).

SJRenew's E&RR Plan provides a list of emergency scenarios that could occur during the injection and post-injection phases of the project. These scenarios include an injection well failure, unexpected CO₂ or formation fluid migration, unexpected CO₂ accumulation in indoor air, and groundwater or surface water contamination.

² Although only a small fraction of GS sites are expected to require E&RR, all sites need to be financially capable of facing an emergency (40 CFR 146.84(a)(2)(iv)). As such, the Cost Tool will overestimate the actual E&RR costs incurred by most sites, but not overestimate the funds required for financial responsibility for E&RR.

The Cost Tool develops E&RR cost estimates for projects where a USDW is present based on scenarios that include activities to remediate mechanical integrity failures and USDW contamination. Activities to address USDW contamination include ceasing injection, creating a hydraulic barrier to contain fluid movement upward and/or laterally, installing chemical sealant to stop the CO₂ leak, and treating contaminated water.

SJRenew's estimate is based on the cost of performing groundwater remediation. While it does not include estimates for repairing damaged wells, the groundwater remediation component of the Cost Tool estimate accounts for the majority of the Cost Tool's estimate for emergency and remedial response (with well repair accounting for less than \$150,000 of the total). Therefore, the two estimates appear to be similar.

Questions/Requests for the Applicant:

- What dollar year do the cost estimates represent?
SJRenew responded that the cost estimates are in 2021 dollars and added a note to the cost estimate spreadsheet. The response is acceptable.

- EPA recommends that the cost estimate be revised to include:

- Annual fluid sampling in all 11 USDW monitoring wells.
- O&M costs for the Vedder Formation well.

SJRenew added the requested items to their PISC cost estimate. SJRenew's estimate for annual fluid sampling in the USDW assumes that each sample costs \$3,500, with samples taken in each of 11 wells annually for 15 years (for a total of \$577,500). There is also a line item for one "USDW geochemical monitoring" sample (unit cost of \$2,000); it is unclear if this duplicates one of the 11 wells. Unit costs for sampling in the USDW and deeper monitoring wells vary from \$2,000 to \$5,000, although the analytes will be the same, per the Testing and Monitoring Plan.

SJRenew also added a line item for O&M in the Vedder Formation well as requested; it includes a unit cost of \$75,000, for a total of \$1,125,000 over 15 years.

SJRenew also revised their cost estimate for corrective action to reflect updated information in the AoR and Corrective Action Plan (i.e., that no corrective action is needed) based on the revised AoR delineation approach. While EPA's review of the revised AoR delineation approach is ongoing, the table below compares EPA and SJRenew's cost estimates based on SJRenew's revised assumptions about the size of the AoR and the number of wells needing corrective action. All other Cost Tool inputs remain the same.

SJRenew's estimate for PISC and Site Closure falls below the lower edge of the range generated by the Cost Tool, as shown in the table below.

Financial Responsibility Categories	B. EPA Cost Tool estimate (2021\$), based on revised assumptions	SJRenew revised submission (2021\$)	Notes
Corrective Action	\$- to \$-	\$-	SJRenew asserts that no wells require corrective action.
Injection Well Plugging	\$129,800 to \$311,520	\$234,600	
PISC and Site Closure	\$8,403,960 to \$14,948,240	\$5,191,700	Revised AoR is much smaller: from 73 miles to 1.49 miles. SJR's estimate for PISC falls below the Cost Tool range.
E&RR	\$13,027,200 to \$89,996,240	\$25,338,750	
Total Amount Needed to Show FR	\$21,560,960 to \$105,256,000	\$30,765,050	

- Please add or fix the table numbers for injection well plugging, site closure, and emergency and remedial response in the cost estimation spreadsheet.
The table numbers were revised as requested.

Follow-up Questions/Requests for the Applicant:

- Please explain the relationship between the rows, "USDW geochemical monitoring" and "Annual fluid sampling USDW wells (11)."

- *Please clarify the differences in the unit cost for the USDW monitoring wells and for the deep monitoring wells, given that the analytes are the same.*
- *What is the source of the unit costs for sampling in the USDW and deeper monitoring wells, and does it reflect all analytes in the Testing and Monitoring Plan?*
- *Please explain why the multiplier for O&M costs in the ACZ monitoring well is 3 and not 15 years.*

Considerations Based on the Results of Pre-Operational Testing/Modeling Updates:

- *Confirm assumptions about the number, depth, and diameters of the monitoring wells based on final plans/as-built specifications.*
- *Confirm the appropriateness of the area over which 3D seismic surveys will be performed (additional discussion will be provided in EPA's testing and monitoring evaluation), and revise the post-injection site care cost estimate if needed.*
- *Changes to various Cost Tool inputs (e.g., the size of the AoR based on final modeling, the total volume of CO₂ to be injected, and corrective action needs at the time the permit is issued) may affect the estimates generated by the Cost Tool.*

PART 2: Financial Instrument Demonstration

SJRenew submitted an October 5, 2021 Letter of Intent from New Energy Risk to provide insurance to meet SJRenew's financial responsibility requirements. The letter does not indicate what aspects of the project the New Energy Risk intends to cover or provide any specific information about the instrument language or guarantee insurance coverage. Rather, the letter describes the strength of New Energy Risk and their ability to address financial responsibility needs for carbon storage projects. SJRenew and New Energy Risk intend to work with EPA to develop the specific instrument language.

It is anticipated that SJRenew will provide this additional information and draft insurance policy language as the time for issuance of the Class VI permit nears. EPA recommends that SJRenew consult the *UIC Program Class VI Financial Responsibility Guidance* as it develops the instruments, including:

- The required and recommended specifications for insurance (in Section 5.E), and
- The recommended financial instrument language for a certificate of insurance in Appendix B.

Question/Request for the Applicant:

- *Does SJRenew plan for insurance to cover all activities, i.e., corrective action, well plugging, post-injection site care and site closure, and emergency and remedial response?*
SJRenew responded that it plans to use a combination of insurance and/or a surety bond for all activities if a surety bond is an acceptable alternative. These instruments will need to be provided and evaluated prior to permitting; however, the response is acceptable at this point.

Appendix A
EPA Cost Estimation Inputs

Parameter	EPA Input	Source/Notes
Size of Area of Review (AoR)	73 sq. miles	Permit application narrative, pg. 3
Are there USDWs in the AoR?	Yes	USDWs are described in Section 2.4.2 of the permit application narrative
Mass of CO ₂ to be Injected	6,570,000 tons	Permit application narrative, pg. 29
Duration of Post-Injection Site Care	15 years	PISC and Site Closure Plan
Depth of Injection Well	8,700 feet	Figure 3-1 of the permit application narrative
Diameter of Injection Well	7.0 inches	Figure 3-1 of the permit application narrative
Monitoring Well Plugging		
ACZ (Olcese) well depth	7,095 feet	T&M Plan, pg. 6: One ACZ well screened in the Olcese Formation, which occurs from approximately 6,625 to 7,095 ft
ACZ well diameter	7.0 inches	No construction details about the monitoring well is provided in the application; EPA estimates 7 inches, consistent with other application reviews
Vedder Formation well depth	6,672 feet	PISC and Site Closure Plan, pg. 4
Vedder Formation well diameter	7.0 inches	No construction details about the monitoring wells is provided in the application; EPA estimates 7 inches, consistent with other application reviews
Delano Well 14 depth	2,001 feet	Per Figure 2 of the T&M Plan, depth is 197 feet; however 2,001 feet is the minimum depth for Cost Tool calculations
Delano Well 14 diameter	4.0 inches	Not provided; EPA estimate
Delano Well 23 depth	2,001 feet	Depth is 214 ft in Figure 2 of the T&M Plan; 2,001 feet used in Cost Tool
Delano Well 23 diameter	4.0 inches	Not provided; EPA estimate
Delano Well 30 depth	2,001 feet	Depth is 100 ft in Figure 2 of the T&M Plan; 2,001 feet used in Cost Tool
Delano Well 30 diameter	4.0 inches	Not provided; EPA estimate
McFarland Taylor Ave. depth	2,001 feet	Depth is 42 ft in Figure 2 of the T&M Plan; 2,001 feet used in Cost Tool
McFarland Taylor Ave. diameter	4.0 inches	Not provided; EPA estimate
SSJMUD Well 14 depth	2,001 feet	Depth is 136 ft in Figure 2 of the T&M Plan; 2,001 feet used in Cost Tool
SSJMUD Well 14 diameter	4.0 inches	Not provided; EPA estimate
SSJMUD Well 23 depth	2,001 feet	Depth is 278 ft in Figure 2 of the T&M Plan; 2,001 feet used in Cost Tool
SSJMUD Well 23 diameter	4.0 inches	Not provided; EPA estimate
SSJMUD Well 42 depth	2,001 feet	Depth is 123 ft in Figure 2 of the T&M Plan; 2,001 feet used in Cost Tool
SSJMUD Well 42 diameter	4.0 inches	Not provided; EPA estimate
SSJMUD Well 53 depth	2,001 feet	Depth is 131 ft in Figure 2 of the T&M Plan; 2,001 feet used in Cost Tool
SSJMUD Well 53 diameter	4.0 inches	Not provided; EPA estimate
SSJMUD Well 59 depth	2,001 feet	Depth is 112 ft in Figure 2 of the T&M Plan; 2,001 feet used in Cost Tool
SSJMUD Well 59 diameter	4.0 inches	Not provided; EPA estimate
SSJMUD Well 62 depth	2,001 feet	Depth is 83 ft in Figure 2 of the T&M Plan; 2,001 feet used in Cost Tool
SSJMUD Well 62 diameter	4.0 inches	Not provided; EPA estimate
SSJMUD Well 8 depth	2,001 feet	Depth is 329 ft in Figure 2 of the T&M Plan; 2,001 feet used in Cost Tool
SSJMUD Well 8 diameter	4.0 inches	Not provided; EPA estimate
Wells Needing Corrective Action		
API# 402930522 depth	7,250 feet	AoR CA, Table 2-1
API# 402930522 diameter	7.625 inches	AoR CA, Appendix C
API# 402930605 depth	7,214 feet	AoR CA, Table 2-1
API# 402930605 diameter	7.625 inches	AoR CA, Appendix C
API# 402930607 depth	6,850 feet	AoR CA, Table 2-1
API# 402930607 diameter	7.625 inches	AoR CA, Appendix C
API# 402930608 depth	6,530 feet	AoR CA, Table 2-1
API# 402930608 diameter	11 inches	AoR CA, Appendix C
API# 402970053 depth	9,103 feet	AoR CA, Table 2-1
API# 402970053 diameter	10.75 inches	Unknown; but the intermediate casing is 10.75 inches, per AoR CA, Appendix C
API# 402980729 depth	8,290 feet	AoR CA, Table 2-1
API# 402980729 diameter	8.75 inches	AoR CA, Appendix C

¹ All Cost Tool inputs for EPA's evaluation are based on the permit application and are preliminary; the final cost estimates will reflect the UIC permit conditions and the approved project plans.

Appendix B
SJRenew Cost Estimates

Table 1. Financial Responsibility Cost Summary

Activity	Estimated Cost	Reference
Corrective Action on wells in AoR	\$ 1,329,000	Table 2
Plugging Injection Wells	\$ 234,600	Table 3
Post-Injection Site Care	\$ 3,066,000	Table 4
Site Closure	\$ 423,200	Table 5
Emergency and Remedial Response	\$ 25,338,750	Table 6
Total	\$ 30,391,550	

Table 2A. Costs, Plugging Deficient Wells

Well API	Well	Cost	Reference
04-029-30608	Chevron 32-15	\$ 148,000.00	A
04-029-30522	Curry 1	\$ 170,000.00	A
04-029-30607	Del Fortuna 1	\$ 189,000.00	A
04-029-80729	Ingram 13-73	\$ 188,000.00	A
04-029-30605	KCL 87-25	\$ 229,000.00	A
04-029-70053	Tenneco 11x-31	\$ 237,000.00	A
Total		\$ 1,161,000	

Table 2B. Costs, Corrective Action Total

Activity	Unit	Unit Cost	Total	Reference
Revise TOUGH Model	400 hrs	\$ 200	\$ 80,000	-
Review CalGEM Well Database	40 hrs	\$ 200	\$ 8,000	-
Plug Deficient Wells	6 wells	see Table 2A	\$ 1,161,000	A
Project Management	400 hrs	\$ 200	\$ 80,000	-
Total			\$ 1,329,000	

Notes

A: Abandonment costs from Driltek

Table 2B. Costs, Injection Well Plugging					
Activity	Unit		Unit Cost	Total	Reference
Injection Well Plugging	1	well	\$ 204,000	\$ 204,000	A
Documentation, project management	1	each	\$ 30,600	\$ 30,600	B
Total				\$ 234,600	
Notes					
A: Abandonment costs from Driltek					
B: 15% of project costs					

EPA note: Injection well plugging costs are labeled as Table 2B in SJRenew's submission, but this is assumed to be Table 3, as referenced in SJRenew's Table 1.

Table 4. Post Injection Site Care Costs					
Activity	Unit	Events, 15 years	Unit Cost	Total (15 years)	Reference
USDW geochemical monitoring	1 well	15	\$ 2,000	\$ 30,000	C
Above Confining zone geochemical, pressure monitoring	1 well	15	\$ 5,000	\$ 75,000	C
Injection zone geochemical, pressure monitoring	1 well	15	\$ 5,000	\$ 75,000	C
Monitoring well O&M, Above confining zone	1 well	3	\$ 27,000	\$ 81,000	A
Mechanical Integrity Test, Injection zone	1 well	3	\$ 35,000	\$ 105,000	A
3D Seismic Surveys	1 survey	2	\$ 600,000	\$ 1,200,000	B
Reporting	250 hour/yr	15	\$ 200	\$ 750,000	-
Project Management	250 hour/yr	15	\$ 200	\$ 750,000	-
Total, 15 years				\$	3,066,000
A: Patrick Engineering, 2013; assumes \$2,000 base cost + \$4.25/ft					
B: U.S. EPA, 2008 Table 3 (inflation adjusted); assumes \$100,000 per square mile and survey of 6 square miles					
C: Assumes 1 geochemical monitoring event per year per well and continuous pressure monitoring with automated gage					

Table 2B. Costs, Site Closure					
Activity	Unit		Unit Cost	Total	Reference
Non-endangerment report	1	each	\$ 40,000	\$ 40,000	-
Injection zone monitoring well plugging	1	well	\$ 174,000	\$ 174,000	A
Above-confining zone monitoring well plugging	1	well	\$ 154,000	\$ 154,000	A
Plugging documentation, project management	1	each	\$ 55,200	\$ 55,200	B
Total				\$ 423,200	
Notes					
A: Abandonment costs from Driltek					
B: 15% of project costs					

EPA note: Site closure costs are labeled as Table 2B in SJRenew's submission, but this is assumed to be Table 5, as referenced in SJRenew's Table 1.

Groundwater Contamination Causal Investigation					
Activity	Unit		Unit Cost	Total	Reference
Planning/permitting	1	each	\$ 1,072,500	\$ 1,072,500	B
Monitoring wells, depth 1,000 ft	5	well	\$ 350,000	\$ 1,750,000	A
Monitoring wells, depth 5,000 ft	3	well	\$ 1,750,000	\$ 5,250,000	A
Abandoned well investigation	5	wells	\$ 25,000	\$ 125,000	-
Former Injection Well Investigation	1	well	\$ 25,000	\$ 25,000	-
Reporting/Project Management	1	each	\$ 2,145,000	\$ 2,145,000	C
Total				\$ 10,367,500	
Groundwater Contamination Remediation					
Activity	Unit		Unit Cost	Total	Reference
Planning/permitting	1	each	\$ 1,548,750	\$ 1,548,750	B
Pumping well, depth 1,000 ft	4	well	\$ 350,000	\$ 1,400,000	A
Pumping well, depth 5,000 ft	4	well	\$ 1,750,000	\$ 7,000,000	A
Groundwater extraction	1	year	\$ 300,000	\$ 300,000	
Above-ground CO ₂ removal (aeration)	1	unit	\$ 150,000	\$ 150,000	
Alternative water supply	1	community/yr	\$ 1,250,000	\$ 1,250,000	D
Former injection well repair	1	well	\$ 225,000	\$ 225,000	E
Reporting/Project Management	1	each	\$ 3,097,500	\$ 3,097,500	
Total				\$ 14,971,250	
Total, Causal Investigation and Remediation				\$ 25,338,750	
Notes					
A: Assumes \$350/ft for permitting, installation, field oversight, logging drilling, and waste					
B: 15% of project costs					
C: 15% of project costs for reporting, 15% of project costs for project management					
D: Assumes \$25/month per capita and 50,000 people					
E: 15% of installation costs					